

Making the most of the media in multimedia

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In many examples of interactive multimedia (IMM), it is evident that the multimedia computer environment is chosen as a delivery medium not because of its multimedia capacity but because of the computer control. In designing instructional sequences with IMM, it is important to make use of the media attributes as well as the computer control if the instruction is to achieve its full potential. This paper will discuss some good and bad examples of the use of IMM technology and will describe strategies by which the multimedia capabilities of CBL can be used to increase the effectiveness of learning materials.

Introduction

Interactive multimedia (IMM) is a delivery medium for education and training that appears to have taken the higher education sector by storm over the past 3 or 4 years. It has many appealing attributes and appears to have unlimited offerings for improving the quality of university teaching. For example, The Committee for the Advancement of University Teaching has put over 75% of its funding into multimedia development projects in the past three years. Many universities now support development units for the express purpose of creating multimedia programs for teaching and learning. It would seem that multimedia can do no wrong.

Like any other instructional delivery medium, multimedia can be used well and it can be used poorly. When we consider the advantages to be gained from this technology, it must be remembered that these can only really be gained from applications that use the technology in sound and proper ways. One of the principal attractions of multimedia to universities is its apparent capacity to replace conventional face-to-face teaching. With multimedia, students are free to learn at their own pace, in their own time and in many cases at a place of their choosing. This, however, is not the real advantage of the use of multimedia over conventional teaching. Multimedia has the ability to achieve significant learning gains and it is this aspect that should guide its usage and development.

The development of multimedia programs follows similar instructional design principles as any other media, but multimedia developments differ significantly from conventional developments in the facilities and features they provide the instructional designer. Much of the advantage of multimedia is to be derived from astute usage of the media elements in interactive and purposeful activities that engage the learner rather than in replicating conventional instruction in this new form. Our observations of much of the multimedia material that is currently being developed and used in instructional programs underutilises the best features of multimedia by failing to take advantage of the ability of this technology to provide and manage meaningful and engaging practice and activity.

Learning from multimedia

Educational theory and commonsense suggests that people learn most when they are actively engaged rather than passive recipients of information. Students are active in the learning process when they are mentally and cognitively consumed with gaining meaning from the information with which they are interacting. Knowledge construction comes when students relate new knowledge to existing knowledge and use this to build links and connections between the two. This form of cognitive activity is called *generative learning* (Wittrock, 1974) and results in students' knowledge frameworks and structures being used for interpreting new information, reasoning from what is known, and for solving

problems (Jonassen, Mayes & McAleese, 1991).

University education normally seeks to develop advanced knowledge and skills development. The instructional strategies that are most suited to this are those that foster deep levels of cognitive processing, reflective thinking and knowledge construction. Traditional instruction is often driven by instructivist principles that expose learners to prescribed and determined inputs. Preferable environments are those where the learner initiates dialogue with an environment that supports and engages the learner.

Multimedia learning environments can be readily designed and built to foster this form of student activity and learning. Typical applications involve microworlds or learning environments in which the students are able to experiment with and manipulate variables to construct their own meaning. Other forms include hypermedia where learners operate in an *information space* and interact with various knowledge forms to derive their own meaning and understanding through guided activities. Multimedia microworlds are able to offer a range of simulated activities and environments removed in only small ways from real world applications.

The forms of multimedia described above are infrequently observed in the products and developments from educational institutions. They represent a far move from traditional instructional designs with which most lecturers and teachers are familiar. A large number of applications are merely electronic reproductions of conventional instructional materials and take little advantage of the new environment apart from the computer delivery. This had led some writers to redefine multimedia as being a form of computer-based learning material distinguishable from other forms by the amount and level of computer control and interactivity (e.g., Allen & Hoffman, 1993). Multimedia is seen as one end of a continuum describing computer-based instructional materials with sequential links between instructional and media elements. At the other extreme is hypermedia where links exists between all instructional and media elements to facilitate wide and unstructured forms of user access and interaction (Figure 1).

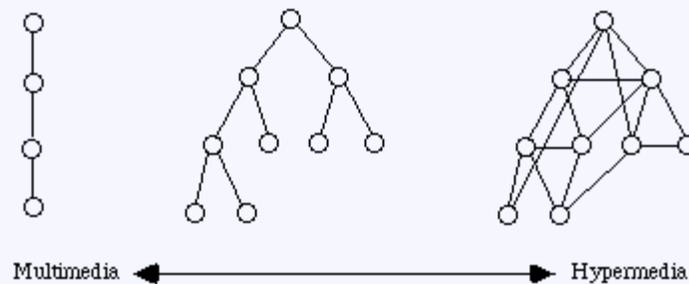


Figure 1: A continuum describing the architecture of computer-based learning materials.

If teachers and developers are to maximise the effectiveness of multimedia programs, it is essential to utilise the media attributes that characterise the technology and contribute to its strength as an instructional tool. This necessarily entails moving along the continuum and structuring presentations and activities to create instructional environments where the user plays an active and engaging role in the learning process.

Media attributes

What are the strengths of the medium? What is the unique combination of attributes that make up multimedia, and how can we exploit those characteristics to improve student learning? From an instructional design perspective there are a number of discrete attributes that can be combined in many ways to form the instructional episode. Multimedia is best when it utilises its strengths and unique attributes. These include:

Use of colour

Colour can be used effectively in multimedia programs, not just for visual appeal, but also as an integral part of the design. It can be used to signal various elements of the interface to assist students' intuitive 'feel' and discrimination whilst working in the program. Colour can be used to:

- Communicate the overall structure of the program
- Link logically-related elements
- Differentiate between required and optional data
- Highlight student responses
- Separate various screen areas such as visuals, text, instructions, prompts and commands
- Emphasise key points (Milheim & Lavix, 1992).

Animation

Animation is a powerful attribute which, within the context of instructional programs, usually has little or nothing to do with cartoons, except for occasional 'user friendly' cartoon characters which guide the learner through the instructional sequences. Animation is frequently used - particularly in opening sequences - simply for its visual appeal, but it is best used to graphically illustrate cause and effect and temporal relationships (e.g., Rieber, 1991; Mayer & Anderson, 1992) .

Ability to incorporate a variety of media

With some limitations, multimedia has the ability to present a variety of media on the one platform, thereby drawing upon the unique attributes and strengths of text, video, and sound. The limitations are that the text is more difficult to read on a screen than in a convenient book, the quality of Quicktime video is very poor compared to a VHS tape, and the sound is acceptable. But the *combination* of elements presents the teacher with the opportunity to use the features of the available media that are most appropriate to achieve the requirements of the task. Integrated multimedia environments combine the symbolic and processing capabilities and enable learners to connect their knowledge to other domains (Kozma, 1991).

Learner control of navigation and direction

Unlike video, audio and text to some extent, which are essentially linear, multimedia allows the learner to control the way he or she will use and work through the program. Capitalising on this feature means that the student can plan, structure and sequence his or her own learning experience. Studies of learner control have identified a number of positive gains including increased motivation, increased self determination and increased achievement gains over more structured forms of the same materials. Learner control is more suited to advanced than initial knowledge acquisition (e.g., Becker & Dwyer, 1994; Shin, Schallert & Savenye, 1994).

Provide engaging interaction

Multimedia can readily incorporate opportunities for the learner to interact in a meaningful way with the material. Activities and exercises give the learner an opportunity to demonstrate his or her understanding of the concepts presented. Well-designed multimedia learning environments enable learners to engage in the process of creating, elaborating or representing knowledge rather than simply viewing different representations of content as is commonly the case with conventional knowledge-based activities (Hannafin, 1992).

Immediate feedback

Multimedia learning environments have the capacity to provide feedback in a range of forms and under a variety of predetermined conditions. Feedback can be used to reinforce learning or as part of the information processing cycle. Continuous feedback can also be provided in activities where the effect of a student action or response can immediately be seen on the screen, for example, the effect that changing a single variable has on a graph. Feedback acts strongly as an information source and serves to provide interactions that result in mutual influence between learners and their environments. The use of feedback in instructional applications significantly influences the nature and form of learning that is achieved (Mory, 1992).

Provide realistic problem-based contexts and simulations

Multimedia is an ideal platform for presenting stimulating and challenging problems and realistic simulations. The student can be immersed into a real-life situation without any of the inherent real-life dangers and consequences. The provision of a realistic context, combined with authentic tasks and activities, can provide a learning environment that demands higher order thinking and problem solving to achieve a satisfactory outcome. The most effective learning is that which is most meaningful and therefore is transferable. This form of learning is case-based and involves meaningful real-world tasks. Multimedia is best used when the instruction provides contextually based environments that are meaningful to the learners (Brown, Collins & Duguid, 1989; Jonassen, Mayes & McAleese, 1993).

Multimedia programs that ignore the attributes and strengths of the medium is multimedia at its worst. But some attention to the design of the program to capitalise on the unique characteristics of multimedia will result in a program which encourages higher order thinking and learning, and is challenging and enjoyable to use.

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